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RISK PERCEPTIONS FOR TYPE 2 *DIABETES MELLITUS* AMONG COLLEGE
STUDENTS

by

James Seth Simmons

A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the
requirements of the Sally McDonnell Barksdale Honors College

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ACKNOWLEDGEMENTS

First, I would like to give a special thanks to Ifeoluwa Tobi Popoola (CSA,MBA) who spent countless hours working with me to analyze my data and help me to make sense of my research. I would not have been able to accomplish all of this without you. Additionally, I would like to thank Dr. John Bentley for helping me to interpret my data and statistical model.

Next, I would like to thank my advisors, Dr. Novicevic, Dr. Allison Ford-Wade, and Dr. Dwight Frink for continuing to push me along and encourage me throughout this entire process, even when things weren't going well.

I would also like to thank all of those at the Sally McDonnell Barksdale Honors College for a great four years. I will always cherish the time that was spent there and the lifelong friendships that I have formed with faculty, staff, and peers.

Lastly, I would like to thank my mother, father, and all of my friends and classmates that have provided me with continuous support over the last year as I worked on my thesis. I am forever grateful for all the kind words, phone calls, and messages of support that I have received during this process, and I certainly wouldn't have made it without their help.

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LIST OF ABBREVIATIONS USED

ER-Environmental Risk Perceptions

GPR- General Public Risk Perceptions

RPS-DD- Risk Perception Survey for Developing Diabetes

PHR- Personal Health Risk Perceptions

RPT- Risk Perceptions of Type 2 *Diabetes Mellitus*

T1DM- Type 1 *Diabetes Mellitus*

T2DM- Type 2 *Diabetes Mellitus*

ABSTRACT

With the number of cases of Type 2 diabetes mellitus on the rise among the world's adolescent population, there is an increasing need for more information concerning the adolescent perceptions of risk to acquire diabetes. While there is an abundance of available data on adult risk perceptions for developing this disease, the research on younger individuals' risk perceptions is scarce. Therefore, this study examines data of risk perceptions of students between the ages of 18 and 25 that are undergraduate students at the University of Mississippi. The specific goal of the survey is to examine which groups of individuals feel most at risk for developing Type 2 diabetes, and also to discern any variables or underlying causes that may cause them to answer in such a manner. By doing so, the data will help to contribute to the continuing conversation that is needed between health professionals and laypeople in order to lead to more favorable health-related outcomes.

INTRODUCTION

Diabetes mellitus, which belongs to “a group of metabolic disorders involving high blood glucose levels over a prolonged period of time” (“Definition of Diabetes Mellitus”), is one of the most common and pervasive chronic illnesses in the world. It is especially common in the United States, where it was the seventh-leading cause of death in 2014 (Centers for Disease Control, 2017). These frightening outcomes arise from the fact that this illness affects over 30.3 million American individuals of all ages, which equates to approximately 9.4% of the nation’s population.

Awareness of this illness is therefore critical because 23.8% of those affected were not aware of or did not report having diabetes, suggesting that diabetes often remains ignored or undetected for long periods of time (See Figure 1). Awareness of diabetes mellitus in the population is extremely important because this disease is accompanied with a plethora of chronic health complications, including, but not limited to, vision loss or blindness, kidney damage and/or failure, nerve pain and damage, heart and cardiovascular disease, high blood pressure, dental issues, and even the loss of extremities.

Table 1. Estimated number and percentage of diagnosed and undiagnosed diabetes among adults aged ≥18 years, United States, 2015

| Characteristic | Diagnosed diabetes No. in millions (95% CI) ^a | Undiagnosed diabetes No. in millions (95% CI) ^a | Total diabetes No. in millions (95% CI) ^a |
|---------------------|--|--|--|
| Total | 23.0 (21.1–25.1) | 7.2 (6.0–8.6) | 30.2 (27.9–32.7) |
| Age in years | | | |
| 18–44 | 3.0 (2.6–3.6) | 1.6 (1.1–2.3) | 4.6 (3.8–5.5) |
| 45–64 | 10.7 (9.3–12.2) | 3.6 (2.8–4.6) | 14.3 (12.7–16.1) |
| ≥65 | 9.9 (9.0–11.0) | 2.1 (1.4–3.0) | 12.0 (10.7–13.4) |
| Sex | | | |
| Women | 11.7 (10.5–13.1) | 3.1 (2.4–4.1) | 14.9 (13.5–16.4) |
| Men | 11.3 (10.2–12.4) | 4.0 (3.0–5.5) | 15.3 (13.8–17.0) |
| | Percentage (95% CI) ^b | Percentage (95% CI) ^b | Percentage (95% CI) ^b |
| Total | 9.3 (8.5–10.1) | 2.9 (2.4–3.5) | 12.2 (11.3–13.2) |
| Age in years | | | |
| 18–44 | 2.6 (2.2–3.1) | 1.3 (0.9–2.0) | 4.0 (3.3–4.8) |
| 45–64 | 12.7 (11.1–14.5) | 4.3 (3.3–5.5) | 17.0 (15.1–19.1) |
| ≥65 | 20.8 (18.8–23.0) | 4.4 (3.1–6.3) | 25.2 (22.5–28.1) |
| Sex | | | |
| Women | 9.2 (8.2–10.3) | 2.5 (1.9–3.2) | 11.7 (10.6–12.9) |
| Men | 9.4 (8.5–10.3) | 3.4 (2.5–4.6) | 12.7 (11.5–14.1) |

CI = confidence interval.

^a Numbers for subgroups may not add up to the total because of rounding.

^b Data are crude, not age-adjusted.

Data source: 2011–2014 National Health and Nutrition Examination Survey and 2015 U.S. Census Bureau data.

Figure 1: Estimated number and percentage of diagnosed and undiagnosed diabetes among adults aged ≥ 18 years, United States, 2015. Provided by the National Center for Chronic Disease Prevention and Health Promotion.

Diabetes mellitus is commonly manifested into two different forms or “types.” The first type of diabetes (Type 1 diabetes mellitus, abbreviated as T1DM) is an autoimmune disorder involving the body’s inadequate production of the hormone insulin, which works to lower glucose levels in the blood. The second type of diabetes (Type 2 diabetes mellitus, abbreviated as T2DM) is a form of the disease in which the target cells of insulin are no longer responsive to its effects, causing glucose to build up in the bloodstream instead of being distributed among cells for energy use, and thus engendering complications begin to arise over time (Mayo Clinic 2018). The focus of this paper, in terms of the literature review and data collection and analysis, is only on Type 2 diabetes mellitus (abbreviated by T2DM). This is in line with the common practice that most of the data concerning diabetes refer to Type 2 diabetes because 90-95% of those diagnosed with the disease have Type 2.

Today one of the most pressing concerns related to diabetes is that its symptoms are increasingly observed and diagnosed with younger age groups. Less than twenty years ago, T2DM accounted for less than 3% of new-onset cases of diabetes in adolescents, whereas today it contributes to over 45% of cases (D’Adamo and Caprio 2011). Therefore, T2DM, which was once referred to as “adult-onset” diabetes, does not quite fit its name anymore, as the prevalence of cases in adolescents and children has dramatically grown. According to 2015 data published by the Centers for Disease Control, there were 132,000 children and adolescents in the United States under the age of 18 that were diagnosed with T2DM, which is 0.18% of the overall adolescent population (Centers for Disease Control). However, it is believed that around 78 million individuals are pre-diabetic, and 7 million more individuals have not yet been diagnosed. Pre-diabetes is defined as a condition in which the patient does not yet exhibit the symptoms to be officially diagnosed with diabetes but does have

abnormally high blood glucose levels. Although pre-diabetes does not warrant a diagnosis for diabetes, it does significantly increase one's chances of becoming diabetic.

Various risk factors may contribute to the development and diagnosis of T2DM. Some of these factors are non-modifiable, such as family history, race, ethnicity, and age. According to the National Nutrition and Health Survey, evidence related to family history & genetics showed that individuals with "at least one first-degree relative in the same maternal or paternal ancestry with T2DM and at least two first-degree relatives with T2DM" were 2.3 and 5.5 times more likely to be diagnosed with Type 2 diabetes. In addition to family history, race & ethnicity also play a significant role in the prevalence of T2DM.

According to the 2017 National Diabetes Statistics Report, prevalence of diabetes was highest among American Indians/Alaska Natives (15.1%), non-Hispanic blacks (12.7%), and Hispanics (12.1%). Additionally, increasing degrees of education have been proven to contribute significantly to lower the prevalence of T2DM. Specifically, individuals without a high school degree exhibited a 12.6% prevalence of diagnosed diabetes cases, compared to 9.5% for high school graduates, and 7.2% for those with a post-high school education. In terms of modifiable risk factors of T2DM, diet and exercise are the two most commonly known "self-management" behaviors that have a favorable impact on health in general and diabetes in particular.

Past studies found that an individual's "perceived" risk of diabetes is a crucial part of whether or not individuals take steps to prevent or treat symptoms. Perceived risk is formally defined as "the person's perceived 'susceptibility' or 'vulnerability' to a condition" (Janz and Becker, 1984). Perceiving one's risk of acquiring diabetes is important, because it serves as an indicator as to whether or not the individual is aware that action needs to be

taken to control his or her health outcomes (Rouyard). On one hand, if individuals underestimate the severity of their risk, they are unlikely to engage in behaviors that improve their health, while, on the other hand, overestimating risks can lead to unnecessary stress.

One of the biggest misconceptions of risk perception is that it is not simply a mathematical probability that can be measured accurately and assessed outright. Risk perception is in reality complex and multidimensional, with several different facets that support an overall picture of one's perception of a given risk. In general, perceived risks can be classified into three categories, which are absolute, comparative, or conditional risks (Rouyard 2016). First, absolute risk refers to the difference between one's perceived risks and actual outcomes. Second, comparative risk refers to one's perceptions of risk relative to another individual or relative to an average member of the population. Lastly, conditional risk refers to risk perceptions that outcomes will occur *if* a certain behavior is adopted over the time period being studied.

Another important concept that creates a challenge to researchers attempting to measure risk perception is the concept of "optimistic bias." Essentially, optimistic bias, also referred to as the "illusion of invulnerability," reflects the tendency that most people have to underestimate their own likelihood of experiencing negative events in their life, while at the same time overestimating the probability that more positive events would occur (Rouyard et al, 2016). The optimistic bias tends to be common with younger groups, as adolescents are unlikely to fully understand the long-term consequences of their ongoing health-related behaviors.

Literature Review

Although the research on adolescent perceptions regarding T2DM is still in the nascent stage, several studies that have established the research directions of the subject. In 2016, a group of researchers from the Health Economics Research Centre at the University of Oxford published a systematic review of studies that explored the perceptions of risk for diabetes-related complications in T2DM. The review included a total of 18 total studies, in which a mix of qualitative and quantitative methods was used. Out of the 18 studies, 12 studies focused only on cardiovascular risks of T2DM, while the remaining six included microvascular risks such as complications with the eyes, hands, and feet. Overall, 23 “outcomes” were addressed. These outcomes were further classified into five different categories: absolute accuracy, comparative risk, risk questionnaires and risk perception scores, and complementary evidence.

For the first category of absolute accuracy, which refers to average individual perceived absolute risks, the findings were mixed, but there was a common tendency among individuals towards overestimation of possible heart attack and stroke. Only one study showed an underestimation of the risk of diabetes-related eye complications. In terms of optimistic bias, one study showed that outcomes were higher among minority ethnic populations and among those with lower levels of education. Additionally, one study by Homko *et. al*, 2018, indicated that women tended to exhibit a higher perceived risk for cardiovascular disease compared to men. In the qualitative studies, which involved focus groups and semi-structured interview formats, the findings indicated that a large proportion of the groups, including 70% of respondents with T2DM in one of the larger studies, did not even realize that they were at risk for cardiovascular disease at all.

Another study conducted in 2003 by researchers from the Diabetes Research and Training Center at the Albert Einstein College of Medicine was designed to explore the comparative risk judgments for diabetes of physicians in the northeastern United States and Canada. In this study, 535 non-diabetic individuals were surveyed using the instrument of the Risk Perception Survey for Developing Diabetes (RPS-DD). At the beginning of the study, the sample was split into two groups, one containing higher-risk subjects and the other containing lower-risk individuals, according to self-reported answers from the American Diabetes Association Diabetes Risk Test. The survey instrument contained 53 items, including different subscales to address multiple dimensions of risk perception. Some of the individual items included questions about worry of developing diabetes, knowledge of diabetes risk factors, and the amount of personal control felt over preventing diabetes. The survey also included a comparative risk section that perceived risk across 15 different diseases, as well as an environmental risk section with the questions external health risks such as crime, dangerous chemicals, and second-hand smoke.

The findings of the study indicated that the level of the self-reported higher risk groups were significantly different from the level of the lower risk groups. The findings included lower sense of personal control, higher worry about developing diabetes, and a greater overall perceived risk across multiple other diseases. In terms of optimistic bias, the lower-risk groups showed a higher level of optimistic bias, but 50% of the higher-risk group members reported they were less likely than others of the same age and gender to develop diabetes. The researchers found that this finding was supported by their pilot study of non-physician community subjects, in which the same proportion of the high-risk group answered in a similar manner, the questions about comparative risk. Overall, the study

provided important evidence that optimistic bias can exist in any population or community, and that a better understanding of both professional and lay groups-attitudes toward developing diabetes is an important step in helping to overcome latent barriers of communication between the doctor and the patient.

One of the more focused studies concerning adolescent risk perceptions of T2DM was reported in the dissertation of Natalie Fischetti at Rutgers University. In her study, Fischetti used a cross-sectional design to survey a group of high school students and Boy Scout troop members in New York City. The total sample included 80 participants, with ages ranging from 13-18 years old, and comprised 35 male and 45 female students. The sample population excluded students who had any family history of Type 1 or Type 2 diabetes. The study was designed to test the hypothesized relationship between perceived T2DM risk and diet and exercise regimens. Four different survey instruments were used in the study. First, the Godin Leisure-Time Exercise Questionnaire was used to evaluate physical activity on a weekly basis. Second, Fischetti also adapted the “Risk Perception Survey for Developing Diabetes,” an adult survey, into a revised 14-item survey geared toward adolescents. Third, she added questions about optimistic bias, worry, personal control, dread, and unknown risk. Finally, two 24-hour dietary recalls and a demographic questionnaire were included as well.

Fischetti’s results obtained indicated that while there was no correlation between perceived T2DM risk and dietary intake, there was a positive association between “dread” and carbohydrate intake, as well as an inverse relationship between dread and fat intake. Exercise contributes, Fischetti noted, to a significant inverse relationship between perceived risk and strenuous physical activity. Fischetti pointed out that these findings indicate that not only did teens seem to have a false understanding of the role of carbohydrates in one’s diet,

but also that teens that exercised more, even in moderate amounts, were less likely to perceive T2DM as a risk.

Although Fischetti's study had significant findings, it was not without certain limitations. She warned that because of the novelty of the survey instrument being used, not only some of the reliability coefficients were not as high as they should be based on the accepted standards but also, the problems with the homogeneity and small size of the sample could have contributed to the results.

In a study of high school students designed in a way similar to Fischetti's, Claudia Sealey-Potts and Wanda Reyes-Velazquez surveyed university students to compare their actual T2DM risks to their perceived risks. A total of 660 students participated in the study, including 63.2% female participants and 36.8% male participants. The survey consisted of 27 items, some of which included comparative risk questions, and actual risk questions following diabetes screening guidelines published by the Centers for Disease Control. The actual risk section was scored on total points scale, with points for: parents with diabetes (1), sister or brother with diabetes (1), overweight or obese classification (5), age younger than 65 years with three or less days a week of physical activity (5), as well as classification as an ethnic minority (1). Scores of 3-8 indicated low risk for T2DM, while scores of 9 or higher were considered high risk. The study also asked for demographic information, including age, gender, weight, height, and a BMI. Additionally, participants were polled about their daily fruit and vegetable consumption.

The results supported the hypothesis that those who reported themselves to be at "some" or "great" risk for developing T2DM scored much higher on their actual risk compared to the lower risk groups. Although the mean score of 6.63 indicated a low risk for T2DM, the

researchers observed the discrepancies between the high and low risk groups, with averages of 10.14 and 3.34, respectively.

Interestingly, almost half of the surveyed participants (~300) were unsure of the personal risks related to their lifestyle behaviors, while 26% of the group members were not sure of the risk related to family history. This data is important because it shows that both the high and low risk groups had a significant number of individuals that were unaware of their personal risks, and therefore were probably more likely to underestimate their risk of developing diabetes. Furthermore, the data showed that over 40% of the participants were classified as overweight or obese, which is known as one of the leading contributors to the development of diabetes.

Research Goals

The review of the literature indicates that it is apparent that additional studies should be conducted in researching not only what drives adolescent perceptions of their own health risks, particularly diabetes, but more importantly, how these factors/variables are related. With diabetes on the rise among younger groups of individuals, it is important to examine what relationships between these variables may or may not have a significant effect on adolescents' perceived health risk of acquiring diabetes by adolescents. To contribute to this examination, this thesis will address the following four research questions:

1. What *external* and *environmental* factors influence adolescent risk perception?
2. What *internal* and *personal* factors influence adolescent risk perception?

3. What effect do perceptions of the *general public* have on risk perception?
4. Do these three factors have a relationship with one another, and do they exert an effect on overall risk perception?

These research questions are formalized in the form of the related hypotheses depicted in the model shown in Figure 2 below:

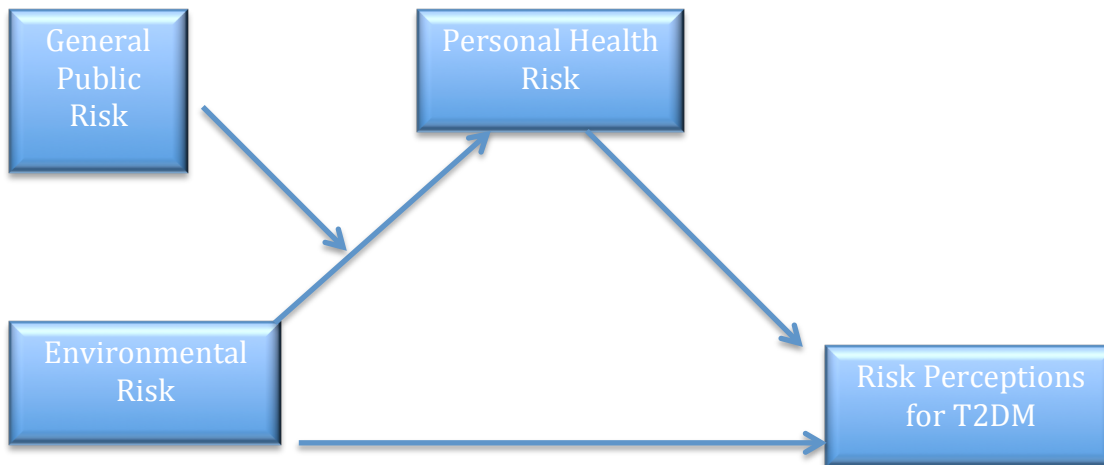


Fig. 2. Moderated Mediation Model

Discussion of Theoretical Model

The model shown in Figure 2 is a moderated mediation model, that describes the indirect effect that an independent variable (x) has on (y) through a mediator (m), which occurs because of the effects of a moderating variable (w). Depending on the value of the “w,” the results of x’s effect on y can vary drastically (Preacher, Rucker, and Hayes). Applying the model to this study, the goal was to determine what effect *environmental* risk perceptions (ER) had on one’s risk perceptions of Type 2 diabetes (RPT). There were also several covariates that were accounted for in the effect, which included exercise, gender, ethnicity, full/part-time status, and school classification. After running the Matrix Process procedure using “Model 7,” as shown in Figure 2, it was found that there was a conditional indirect effect of ER on RPT, mediated by personal health perceptions (PHR). The effects were contingent upon on the value of general public perceptions (GPR), which acted as a moderator in the relationship between ER and PH.

In the model , I statistically analyzed the following theoretical paths:

Direct Paths:

-
- a) Environmental Risk Perception → Public Health Risk Perception
 - b) Moderated path between Environmental Risk Perception → Public Health Risk
 - c) Environmental Risk Perception → Risk Perception for TD2M
 - d) Public Health Risk → Risk Perception for T2DM

Indirect Paths:

a) Indirect path between Environmental Risk Perception → Risk Perception for T2DM → Personal Health Risk Perception

The empirical test of this model yielded the findings described in the subsequent sections of this thesis, which will hopefully be able to contribute to the ongoing conversation that is necessary between health professionals and young adults in order to encourage healthier lifestyles of students and raise their awareness of the need to care their own physical well-being. By acquiring a fuller understanding of the risks that are associated with certain diabetes-related behaviors.

METHODS

Participants and Procedure

To investigate the proposed hypothesis, a cross-sectional survey was conducted. The survey items were adapted from the Albert Einstein College of Medicine's Risk Perception Survey for Developing Diabetes (RPS-DD) instrument, combined with the items from the Godin Leisure-Time Exercise Questionnaire. Data was also collected related to participants' demographic characteristics. All completed response to the survey items were uploaded to and administered through the Qualtrics online survey platform after the Institutional Review Board approved the study (*study number available upon request*). An email was sent to a total of 5000 undergraduate students at a University located in the Southeastern United States. Weekly reminders were sent over a two-week period, to encourage participants to complete the survey. See Appendix A for a list of survey instruments and Appendix B for a copy of the reminder email sent.

Statistical Analyses

The data was analyzed using IBM's (2017) Statistical Package for the Social Sciences (SPSS, version 25); and Andrew Hayes' (2018) PROCESS (version 3.0) statistical software - an Ordinary Least Squares (OLS) regression path analysis modeling tool. The dependent variable measured is RPT, the independent variables included ER, the mediator is PHR, and the moderator is GPR. After ensuring the dataset is cleaned, an exploratory factor analysis was conducted to ascertain factor loadings of each survey instrument. Next the Cronbach's alpha (α), a measurement of the reliability or internal consistency of each factor, was determined, and instruments with alpha levels below 0.7 were discarded. (See Figure 3 for reliability result).

| <u>Reliability</u> <u>Statistics</u> | <u>Cronbach's alpha</u> | |
|---|--------------------------------|--|
| | | |
| RPT Average 1 (Items 3&4) | .778 | |
| ER Average 1 (Items 5-9) | .852 | |
| PHR Average 2 (Items 10, 12, 13, 14) | .773 | |
| GPR Average 1 (Items 4&10) | .728 | |

Fig. 3. Reliability Statistics for Selected Measures

Measures

Details of the measures used in my thesis is described below:

- a. *Risk Perception* (RPT): This variable measures the overall risk perceptions for developing Type 2 diabetes, including feelings of control, worry, and susceptibility of getting the disease. The items of the measure were administered using a four-point Likert-type scale (1=Almost No Risk to 4=High Risk). The items were adapted from the Risk Perception Survey for Developing Diabetes survey (RPS-DD) used by Diabetes Research and Training Center at the Albert Einstein College of Medicine (2003). The scores of the survey items were then averaged together for analysis.

- b. *Public Health Risk* (PHR): This variable involves an individual rating of how likely one is to be at risk for a particular disease, based on one's own personal characteristics, as well as based on family and medical history. For the measure, I used the same four-point Likert-type scale from section *a* (1=Almost No Risk to 4=High Risk). These items were also adapted from the RPS-DD.

- c. *Environmental Risk* (ER): This variable measures one's perceptions of external threats that could have an impact on health, such as secondhand smoke, driving/riding in an automobile, and illegal drugs. (See Appendix A, Section 3 for full list of included items). The measure used the four-point Likert-type scale from *a*

and *b* (1=Almost No Risk to 4=High Risk). The items were adapted from the RPS-DD.

- d. *General Public Risk* (GPR): This variable measures perceptions regarding the influence of various demographic and lifestyles characteristics on the risk of developing T2DM, including age, ethnicity, diet, exercise, and family history. The measures used a 4-point Likert-type scale (1=Decreases the Risk to 4=Don't know)
- e. *Control Variables*: The control variables included gender, ethnicity, full/part-time classification, and exercise. The exercise questions within the survey were adapted from the Godin Leisure-Time Questionnaire, which used a 3-point interval scale (1=1-3 times per week to 3=5+ times per week), while the other demographic characteristics were chosen by the author and provided by the university.

Participants Demography

The initial number of respondents recorded was 325, which represented a response rate of 6.5%, but the sample size was reduced to 155 individuals after the data was cleaned and invalid responses were removed. Invalid responses included individuals who took either too long or not long enough to complete the survey, as well as those who did not completely answer all of the survey questions. The demographic characteristics of the respondents can be found in Appendix D.

Overall, there was a much higher percentage of female survey respondents (70.3%) than males (29.7%). Almost all of the respondents (96.1%) were between the ages of 18-24, while only six of the respondents were over the age of 25. In terms of ethnicity, most of the respondents were white (83.9%), while the remaining groups were represented by a small percentage in the following order: Black (9.0%), Asian (3.2%), Hispanic (2.6%), and Other (1.3%). Additionally, approximately one-third of the respondents reported having at least one family member with a history of diabetes. See Figure 3 below for information on participants' demographics.

| Demographic | | Proportion |
|---------------------|------------------|-------------|
| Results | | (Frequency) |
| Gender | Female | 70.3% (109) |
| | Male | 29.7% (46) |
| Age | 18-20 | 49.7% (77) |
| | 21-24 | 46.5% (72) |
| | 25+ | 3.9% (6) |
| Ethnicity | White | 83.9% (130) |
| | African-American | 9.0% (14) |
| | Asian | 3.2% (5) |
| | Hispanic | 2.6% (4) |
| | Other | 1.3% (2) |
| Classification | Freshman | 17.4% (27) |
| | Sophomore | 21.9% (34) |
| | Junior | 20.6% (32) |
| | Senior | 40% (62) |
| Family | Yes | 32.9% (51) |
| History of Diabetes | No | 67.1% (104) |

Figure 4: Demographic Results

Correlation Results

The correlations, descriptive statistics, and reliabilities of the selected measures are shown in Figure 4. As hypothesized, Environmental Risk was positively correlated with Personal Health Risk ($r=.259$, $p<.01$) at a 99% confidence interval. Additionally, General Public Risk was also positively correlated with Personal Health Risk ($r=.173$, $p<.05$) at a 95% confidence interval. These results indicate that despite the absence of a direct effect of Environmental Risk on Risk Perception for T2DM ($r=-0.045$, $p>0.05$), there still exists a conditional indirect effect on RPT through PHR and moderated by GPR.

| | | RPT | PHR | GPR | ER | Gender Sub. | Gender Obj. | Race | Full/Part-Time | Exercise |
|-------------|---------------------|---------------|---------------|--------|--------------|----------------|--------------|--------|----------------|----------|
| PT | Pearson Correlation | 1 | | | | | | | | |
| HR | Pearson Correlation | 0.139 | 1 | | | | | | | |
| PR | Pearson Correlation | 0.005 | .173* | 1 | | | | | | |
| R | Pearson Correlation | -0.045 | .259** | 0.023 | 1 | | | | | |
| ender Sub. | Pearson Correlation | -0.027 | 0.130 | 0.043 | 0.059 | 1 | | | | |
| ender Obj. | Pearson Correlation | -0.027 | 0.130 | 0.043 | 0.059 | 1.000** | 1 | | | |
| ace | Pearson Correlation | -0.026 | -0.016 | -0.053 | -0.024 | -0.038 | -0.038 | 1 | | |
| ull/Part-me | Pearson Correlation | 0.069 | 0.006 | 0.070 | 0.012 | 0.016 | 0.016 | 0.013 | 1 | |
| xercise | Pearson Correlation | -.205* | 0.133 | 0.002 | .166* | .159* | .159* | -0.037 | 0.011 | |

*. Correlation is significant at the 0.01 level (2-tailed).

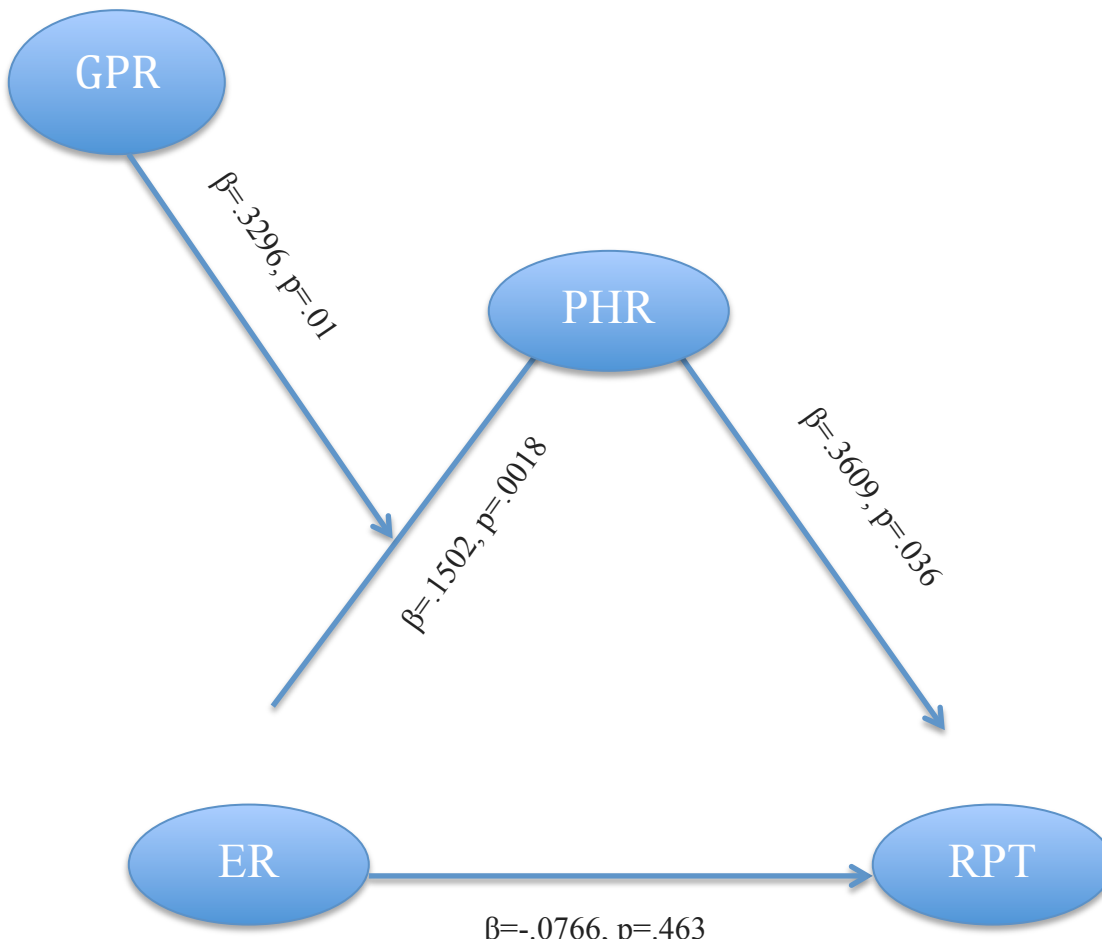
Correlation is significant at the 0.05 level (2-tailed).

fig. 5. Correlation Table & Descriptive Statistics

Mediation Analysis

First, results of the analysis that the relationship between ER and PHR is significant. Specifically, ER predicted PHR ($\beta=.1502$, $p=.0018$). This relationship is significant at the 95% Confidence Interval (CI) level. Second, the interaction term between ER and GPR is significant ($\beta=.3296$, $p=.01$) at the 95% Confidence Interval (CI) level. Next, I calculated the effect of ER and PHR on RPT. Results indicate that while PHR predicts RPT ($\beta=.3609$, $p=.0360$) ER did not statistically predict RPT ($\beta= -.0766$, $p=.4623$). Moreover, PHR mediated the relationship between ER and RPT ($\beta=.0722$). What this suggests is that PHR is having a mediating effect on the relationship between our dependent and independent variables.

Fig. 6. Moderated Mediation Output Model



Moderated Mediation Analysis

After determining that significant mediation exists between our variables, the next step to examine is the effect of the proposed moderator, GPR. In the tables below, GPR has been mean centered (one standard deviation above and below the mean), and the data shows the indirect effects of ER on RPT through a mediating variable. At a negative output, the effect is shown to be insignificant, because zero lies between the lower and upper level confidence. However, when GPR is at its mean and one standard deviation above the mean, it exhibits a significant effect on the model. The full output from SPSS for the analysis can be found in Appendix C.

| GPR | Effect | BootSE | BootLLCI | BootULCI |
|------------|---------------|---------------|-----------------|-----------------|
| -.5444 | -.0105 | .0291 | -.0784 | .0449 |
| .1511 | .0722 | .0331 | .0131 | .1413 |
| .2251 | .0810 | .0369 | .0150 | .1585 |

Fig. 7. Indirect Effect of X (ER) on Y (RPT) through M (PHR)

| | Index | BootSE | BootLLCI | BootULCI |
|------------|--------------|---------------|-----------------|-----------------|
| GPR | .1189 | .0645 | .0141 | .2622 |

Fig. 8 Index of Moderated Mediation

The effects identified in this analysis were also depicted graphically in Figure 9 shown below. In the graph, PHR represents the dependent variable on the y axis, and environmental risk as the independent variable on the x axis. Based on the graph, at low levels of general public risk perception, there is not a positive correlation between one's environmental risk perception and their personal risk perceptions. However, as one's general public perceptions

increases, so did one's environmental risk perceptions, and therefore their own personal health perceptions.

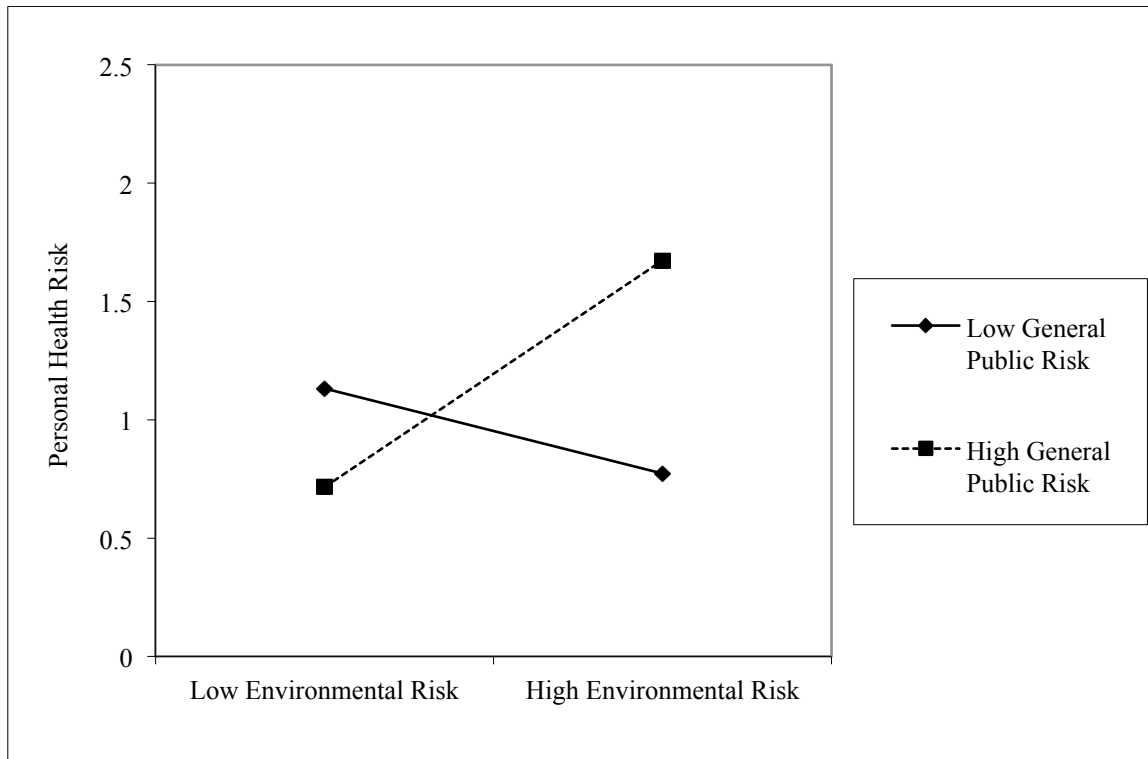


Fig. 9. Moderating effect of GPR on the relationship between ER and PHR

Discussion

The findings of the data analysis support the model shown in Figure 1, which proposes that there are a number of complex factors that affect adolescent risk perception for T2DM. According to the model, one's perception initially begins with his or her interpretation of the environment around them, particularly the events that pose a potential threat to the well-being of the individual. In our analysis, some of the most commonly assessed threats (moderate to high risk) included illegal drugs, riding and/or driving a car, and secondhand cigarette smoke. Next, the individual also developed a unique set of perceptions toward their

own personal health, which vary widely. Among the diseases surveyed in the sample, it was indicated that heart disease, cancer, and high blood pressure were the three issues for which they felt that they were at the highest risk. Lastly, every individual also developed varying risk perceptions towards developing Type 2 diabetes. However, as was stated in the data analysis, the relationship between one's external, personal, and overall T2DM risk perceptions is moderated by perceptions of the general public, which includes both demographic and lifestyle components.

Managerial and Organizational Implications

There are several important implications that result from the findings of this thesis. First, the results support the findings from the literature review indicates that a large number of the individuals that participated in the study were not aware of their risk factors towards T2DM. Regardless whether the risk factors are modifiable are not, they are the factors that everyone should be aware of, to trigger preventative measures can be taken to limit the risk. Education is found to be the single most important tool in fighting Type 2 diabetes, so it is therefore crucial that students are informed about T2DM, starting at a young age. Secondly, it is also essential that healthcare professionals make a stronger effort to communicate information concerning T2DM to their patients. Discussing diet and exercise, as well as testing blood-glucose levels on a more regular basis could have a significant impact on the outcomes of adolescent health.

Limitations and Conclusions

Overall, there is still much more research that needs to be performed in adolescent populations in order to assess risk perceptions for Type 2 diabetes. One of the biggest limitations associated with this particular study was the somewhat limited sample size of 155 individuals. In order to more comprehensively examine a representative sample of the population, the study would need to include closer to 500-1000 participants. Also, some items on the scale measured responses that proved to be unreliable, so future studies should take that into account when designing the components of the survey.

Nevertheless, the findings of this study have hopefully helped to contribute to the continuous development of the knowledge concerning adolescent health. With health trends rapidly declining and sedentary lifestyles taking over much of the world, it is more important than ever to increase the quality of education that young people are receiving to protect their well being. It is in everyone's best interest to continue to strengthen the line of communication between health professionals and laypeople in order to curb the health epidemic that our world is currently facing.

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Appendix A-Qualtrics Survey

Section 1: Risk Perceptions for Type 2 Diabetes (RPT):

Please select the option next to each item that best describes your opinion:

1. I feel that I have little control over risks to my health.
2. If I am going to get diabetes, there is not much I can do about it.
3. I think that my personal efforts will help control my risk of getting diabetes.
4. People who make a good effort to control the risks of getting diabetes are much less likely to get diabetes.
5. I worry about getting diabetes.
6. Compared to other people of my same age and sex, I am less likely than they are to get diabetes.
7. Compared to other people of my same age and sex, I am less likely than they are to get a serious disease.
8. Worrying about getting diabetes is very upsetting.

Answer Choices: (1) Almost No Risk | (2) Slight Risk | (3) Moderate Risk | (4) High Risk

Section 2: Personal Health Risk (PHR):

“Below is a list of health problems and diseases. For each one, please circle the number below the words to tell us if you think **your own personal health** is at "almost no risk," "slight risk," "moderate risk" or "high risk" from these problems.”

1. Arthritis
2. Heart Disease
3. Cancer
4. High Blood Pressure
5. Hearing Loss
6. Asthma
7. Diabetes
8. Osteoporosis
9. Stroke
10. Blindness
11. Infections needing treatment by a doctor
12. Amputation
13. Impotence
14. Kidney failure
15. AIDS/HIV

Answer Choices: (1) Almost No Risk | (2) Slight Risk | (3) Moderate Risk | (4) High Risk

Section 3: General Public Risk (GPR):

We would like you to think about people in the general public and **NOT** about your own personal risk of getting diabetes.”

Select the choice below the words that best describe your opinion about whether each item listed below increases (raises) the risk of someone getting diabetes, has no effect on the risk, or decreases (lowers) the risk of someone getting diabetes.

1. Being Asian American
2. Being Caucasian (white)
3. Being African American
4. Being Hispanic
5. Eating a healthy diet
6. Having diabetes during pregnancy
7. Having one or more blood relatives with diabetes
8. Being 65 years of age or older
9. Exercising regularly
10. Being American Indian
11. Controlling weight gain

Answer Choices: (1) Increases the Risk | (2) Has NO effect on Risk | (3) Decreases the Risk | (4) Don't Know

Section 4: Environmental Risk (ER)

Below is a list of possible hazards or dangerous conditions in the environment around most of us.

For each one, please select the choice below the words to tell us if your own personal health is at "almost no risk," "slight risk," "moderate risk" or "high risk" from each of the following hazards or conditions.

1. Medical X-Rays
2. Violent Crime
3. Extreme weather (hot or cold)
4. Driving/riding in an automobile
5. Illegal Drugs
6. Air Pollution
7. Pesticides
8. Household Chemicals
9. Secondhand cigarette smoke

Answer Choices: (1) Almost No Risk | (2) Slight Risk | (3) Moderate Risk | (4) High Risk

Section 5: Exercise Questions

During a typical 7-day period (one week), how many times on average do you do the following kinds of exercise for more than 15 minutes during your free time?

1. Strenuous Exercise (e.g. football, basketball, soccer, skiing, running)
2. Moderate Exercise (e.g. jogging, biking, tennis, volleyball)
3. Mild Exercise (walking, yoga, golf, bowling, fishing)

Answer Choices: (1) 0-2 times per week | (2) 3-5 times per week | (3) 5+ times per week

Section 6: Demographic Questions

1. What is your gender?

(1) Male | (2) Female

2. What is your age in years?

(1) 18-20 | (2) 21-24 | (3) 25+

3. Please select your race:

(1) African American | (2) Asian | (3) Hispanic | (4) White | (5) Other

4. What is your grade/classification in school?

(1) Freshman | (2) Sophomore | (3) Junior | (4) Senior

5. Do any of your first degree relatives have diabetes (Type 1 or 2)? If "Yes", please indicate which relative.

(1) Yes | (2) No

6. What is your height in feet and inches (ex: 6'1")?

7. What is your weight in pounds?

Appendix B- Participant Recruitment Email

Dear University of Mississippi Student,

We would like to invite you to participate in an honors research study about your attitudes, beliefs and knowledge concerning type 2 diabetes. The survey will take approximately 10 minutes to complete. All of your responses will be collected anonymously. Completion of this survey is completely voluntary.

We value your participation in this study. By clicking on the link below you are agreeing to participate in this research study:

http://uofmississippi.qualtrics.com/jfe/form/SV_1S8bjnUdQ2Iconj

This study has been reviewed by The University of Mississippi's Institutional Review Board (IRB). If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the IRB at (662) 915-7482 or irb@olemiss.edu.

Thank you for your time,

Seth Simmons
School of Business Administration

Appendix C-SPSS Process Output

Run MATRIX procedure:

***** PROCESS Procedure for SPSS Version 3.00 *****

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2018). www.guilford.com/p/hayes3

Model : 7

Y : RPT_AVG1
X : ER_AVG_1
M : PH_AVG_2
W : GPR_AVG1

Covariates:

Exer_1 Gen_Obj Race_Obj Full_Par Class_Ob

Sample

Size: 155

OUTCOME VARIABLE:

PH_AVG_2

Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|-------|-------|-------|--------|--------|----------|-------|
| .3951 | .1561 | .2031 | 3.3764 | 8.0000 | 146.0000 | .0014 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|----------|--------|-------|--------|-------|--------|--------|
| constant | 1.0736 | .2596 | 4.1355 | .0001 | .5605 | 1.5867 |
| ER_AVG_1 | .1502 | .0473 | 3.1733 | .0018 | .0567 | .2438 |
| GPR_AVG1 | .1212 | .0888 | 1.3652 | .1743 | -.0543 | .2967 |
| Int_1 | .3296 | .1262 | 2.6110 | .0100 | .0801 | .5790 |
| Exer_1 | .0659 | .0702 | .9392 | .3492 | -.0728 | .2046 |
| Gen_Obj | .1333 | .0813 | 1.6390 | .1034 | -.0274 | .2939 |
| Race_Obj | -.0137 | .0483 | -.2837 | .7771 | -.1091 | .0817 |
| Full_Par | -.0214 | .1890 | -.1134 | .9098 | -.3950 | .3521 |
| Class_Ob | .0234 | .0329 | .7125 | .4773 | -.0416 | .0884 |

Product terms key:

Int_1 : ER_AVG_1 x GPR_AVG1

Covariance matrix of regression parameter estimates:

| | constant | ER_AVG_1 | GPR_AVG1 | Int_1 | Exer_1 | Gen_Obj | Race_Obj | Full_Par | Class_Ob |
|----------|----------|----------|----------|--------|--------|---------|----------|----------|----------|
| constant | .0674 | .0011 | .0020 | -.0006 | -.0061 | -.0078 | -.0026 | -.0348 | -.0030 |
| ER_AVG_1 | .0011 | .0022 | -.0001 | .0004 | -.0006 | -.0001 | .0000 | .0000 | .0001 |
| GPR_AVG1 | .0020 | -.0001 | .0079 | -.0028 | .0001 | -.0005 | .0004 | -.0012 | .0002 |
| Int_1 | -.0006 | .0004 | -.0028 | .0159 | -.0006 | .0013 | -.0006 | .0009 | -.0002 |
| Exer_1 | -.0061 | -.0006 | .0001 | -.0006 | .0049 | -.0008 | .0001 | -.0003 | .0004 |
| Gen_Obj | -.0078 | -.0001 | -.0005 | .0013 | -.0008 | .0066 | .0000 | -.0002 | .0002 |
| Race_Obj | -.0026 | .0000 | .0004 | -.0006 | .0001 | .0000 | .0023 | -.0001 | .0001 |
| Full_Par | -.0348 | .0000 | -.0012 | .0009 | -.0003 | -.0002 | -.0001 | .0357 | -.0005 |
| Class_Ob | -.0030 | -.0001 | -.0002 | -.0002 | .0004 | .0002 | -.0001 | -.0005 | .0011 |

Test(s) of highest order unconditional interaction(s):

| | R2-chng | F | df1 | df2 | p |
|-----|---------|--------|--------|----------|-------|
| X*W | .0394 | 6.8174 | 1.0000 | 146.0000 | .0100 |

Focal predict: ER_AVG_1 (X)

Mod var: GPR_AVG1 (W)

Conditional effects of the focal predictor at values of the moderator(s):

| GPR_AVG1 | Effect | se | t | p | LLCI | ULCI |
|----------|--------|-------|--------|-------|--------|-------|
| -.5444 | -.0292 | .0808 | -.3612 | .7185 | -.1890 | .1306 |
| .1511 | .2000 | .0522 | 3.8329 | .0002 | .0969 | .3031 |
| .2251 | .2244 | .0568 | 3.9518 | .0001 | .1122 | .3366 |

Moderator value(s) defining Johnson-Neyman significance region(s):

| Value | % below | % above |
|--------|---------|---------|
| -.1557 | 30.3226 | 69.6774 |

Conditional effect of focal predictor at values of the moderator:

| GPR_AVG1 | Effect | se | t | p | LLCI | ULCI |
|----------|--------|-------|---------|-------|--------|-------|
| -.9497 | -.1628 | .1260 | -1.2922 | .1983 | -.4117 | .0862 |
| -.8410 | -.1269 | .1134 | -1.1197 | .2647 | -.3509 | .0971 |
| -.7322 | -.0911 | .1010 | -.9015 | .3688 | -.2908 | .1086 |
| -.6235 | -.0553 | .0891 | -.6199 | .5363 | -.2314 | .1209 |
| -.5148 | -.0194 | .0778 | -.2495 | .8033 | -.1733 | .1344 |

| | | | | | | |
|--------|-------|-------|--------|-------|--------|-------|
| -.4060 | .0164 | .0674 | .2434 | .8080 | -.1169 | .1497 |
| -.2973 | .0523 | .0584 | .8940 | .3728 | -.0633 | .1678 |
| -.1885 | .0881 | .0516 | 1.7081 | .0897 | -.0138 | .1900 |
| -.1557 | .0989 | .0500 | 1.9763 | .0500 | .0000 | .1978 |
| -.0798 | .1239 | .0477 | 2.5953 | .0104 | .0296 | .2183 |
| .0289 | .1598 | .0477 | 3.3480 | .0010 | .0654 | .2541 |
| .1377 | .1956 | .0515 | 3.7990 | .0002 | .0938 | .2973 |
| .2464 | .2314 | .0583 | 3.9682 | .0001 | .1162 | .3467 |
| .3552 | .2673 | .0673 | 3.9715 | .0001 | .1343 | .4003 |
| .4639 | .3031 | .0777 | 3.9024 | .0001 | .1496 | .4566 |
| .5726 | .3389 | .0890 | 3.8100 | .0002 | .1631 | .5147 |
| .6814 | .3748 | .1008 | 3.7161 | .0003 | .1754 | .5741 |
| .7901 | .4106 | .1132 | 3.6285 | .0004 | .1870 | .6342 |
| .8988 | .4464 | .1258 | 3.5499 | .0005 | .1979 | .6950 |
| 1.0076 | .4823 | .1386 | 3.4802 | .0007 | .2084 | .7561 |
| 1.1163 | .5181 | .1516 | 3.4187 | .0008 | .2186 | .8176 |
| 1.2251 | .5539 | .1646 | 3.3644 | .0010 | .2285 | .8793 |

Data for visualizing the conditional effect of the focal predictor:

Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/

ER_AVG_1 GPR_AVG1 PH_AVG_2 .
BEGIN DATA.

| | | |
|--------|--------|--------|
| -.7874 | -.5444 | 1.3158 |
| -.1874 | -.5444 | 1.2983 |
| .8126 | -.5444 | 1.2691 |
| -.7874 | .1511 | 1.2197 |
| -.1874 | .1511 | 1.3397 |
| .8126 | .1511 | 1.5397 |
| -.7874 | .2251 | 1.2094 |
| -.1874 | .2251 | 1.3441 |
| .8126 | .2251 | 1.5684 |

END DATA.

GRAPH/SCATTERPLOT=

ER_AVG_1 WITH PH_AVG_2 BY GPR_AVG1 .

OUTCOME VARIABLE:

RPT_AVG1

Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|-------|-------|-------|--------|--------|----------|-------|
| .2984 | .0890 | .9279 | 2.0524 | 7.0000 | 147.0000 | .0523 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|----------|--------|-------|---------|-------|--------|--------|
| constant | 1.9083 | .5807 | 3.2862 | .0013 | .7607 | 3.0560 |
| ER_AVG_1 | -.0766 | .1039 | -.7370 | .4623 | -.2818 | .1287 |
| PH_AVG_2 | .3609 | .1705 | 2.1165 | .0360 | .0239 | .6979 |
| Exer_1 | -.3708 | .1502 | -2.4683 | .0147 | -.6677 | -.0739 |
| Gen_Obj | -.0147 | .1732 | -.0850 | .9324 | -.3571 | .3276 |
| Race_Obj | -.0565 | .1024 | -.5513 | .5823 | -.2589 | .1460 |
| Full_Par | .3214 | .4029 | .7977 | .4263 | -.4748 | 1.1177 |
| Class_Ob | .0886 | .0702 | 1.2626 | .2087 | -.0501 | .2273 |

Covariance matrix of regression parameter estimates:

| | constant | ER_AVG_1 | PH_AVG_2 | Exer_1 | Gen_Obj | Race_Obj | Full_Par | Class_Ob |
|----------|----------|----------|----------|--------|---------|----------|----------|----------|
| constant | .3372 | .0095 | -.0303 | -.0257 | -.0318 | -.0124 | -.1580 | -.0125 |
| ER_AVG_1 | .0095 | .0108 | -.0042 | -.0022 | -.0002 | .0002 | -.0002 | -.0003 |
| PH_AVG_2 | -.0303 | -.0042 | .0291 | -.0023 | -.0033 | .0002 | .0005 | -.0010 |
| Exer_1 | -.0257 | -.0022 | -.0023 | .0226 | -.0033 | .0002 | -.0013 | .0017 |
| Gen_Obj | -.0318 | -.0002 | -.0033 | -.0033 | .0300 | .0004 | -.0015 | .0009 |
| Race_Obj | -.0124 | .0002 | .0002 | .0002 | .0004 | .0105 | -.0002 | -.0007 |
| Full_Par | -.1580 | -.0002 | .0005 | -.0013 | -.0015 | -.0002 | .1623 | -.0026 |
| Class_Ob | -.0125 | -.0003 | -.0010 | .0017 | .0009 | -.0007 | -.0026 | .0049 |

***** DIRECT AND INDIRECT EFFECTS OF X ON Y

Direct effect of X on Y

| Effect | se | t | p | LLCI | ULCI |
|--------|-------|--------|-------|--------|-------|
| -.0766 | .1039 | -.7370 | .4623 | -.2818 | .1287 |

Conditional indirect effects of X on Y:

INDIRECT EFFECT:

ER_AVG_1 -> PH_AVG_2 -> RPT_AVG1

| GPR_AVG1 | Effect | BootSE | BootLLCI | BootULCI |
|----------|--------|--------|----------|----------|
| -.5444 | -.0105 | .0291 | -.0784 | .0449 |
| .1511 | .0722 | .0331 | .0131 | .1413 |
| .2251 | .0810 | .0369 | .0150 | .1585 |

Index of moderated mediation:

| Index | BootSE | BootLLCI | BootULCI | |
|----------|--------|----------|----------|-------|
| GPR AVG1 | .1189 | .0645 | .0141 | .2622 |

Pairwise contrasts between conditional indirect effects (Effect1 minus Effect2)

| Effect1 | Effect2 | Contrast | BootSE | BootLLCI | BootULCI |
|---------|---------|----------|--------|----------|----------|
| .0722 | -.0105 | .0827 | .0449 | .0098 | .1824 |

| | | | | | |
|-------|--------|-------|-------|-------|-------|
| .0810 | -.0105 | .0915 | .0497 | .0109 | .2018 |
| .0810 | .0722 | .0088 | .0048 | .0010 | .0194 |

***** BOOTSTRAP RESULTS FOR REGRESSION MODEL PARAMETERS

OUTCOME VARIABLE:
PH_AVG_2

| | Coeff | BootMean | BootSE | BootLLCI | BootULCI |
|----------|--------|----------|--------|----------|----------|
| constant | 1.0736 | 1.0658 | .2821 | .4784 | 1.5998 |
| ER_AVG_1 | .1502 | .1501 | .0489 | .0585 | .2489 |
| GPR_AVG1 | .1212 | .1194 | .0898 | -.0602 | .2937 |
| Int_1 | .3296 | .3313 | .1288 | .0968 | .5955 |
| Exer_1 | .0659 | .0661 | .0893 | -.1083 | .2438 |
| Gen_Obj | .1333 | .1334 | .0848 | -.0306 | .3057 |
| Race_Obj | -.0137 | -.0142 | .0530 | -.1145 | .0961 |
| Full_Par | -.0214 | -.0141 | .2103 | -.3879 | .4182 |
| Class_Ob | .0234 | .0235 | .0361 | -.0484 | .0936 |

OUTCOME VARIABLE:
RPT_AVG1

| | Coeff | BootMean | BootSE | BootLLCI | BootULCI |
|----------|--------|----------|--------|----------|----------|
| constant | 1.9083 | 1.9569 | .7799 | .4639 | 3.5796 |
| ER_AVG_1 | -.0766 | -.0702 | .1050 | -.2720 | .1473 |
| PH_AVG_2 | .3609 | .3515 | .1381 | .0769 | .6228 |
| Exer_1 | -.3708 | -.3959 | .1598 | -.7183 | -.0908 |
| Gen_Obj | -.0147 | -.0017 | .1834 | -.3590 | .3591 |
| Race_Obj | -.0565 | -.0487 | .1168 | -.2686 | .1849 |
| Full_Par | .3214 | .3066 | .6397 | -.9955 | 1.5686 |
| Class_Ob | .0886 | .0836 | .0765 | -.0684 | .2345 |

***** ANALYSIS NOTES AND ERRORS

Level of confidence for all confidence intervals in output:
95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
5000

W values in conditional tables are the 16th, 50th, and 84th percentiles.

NOTE: The following variables were mean centered prior to analysis:

GPR_AVG1 ER_AVG_1

NOTE: Due to estimation problems, some bootstrap samples had to be replaced.

The number of times this happened was:

13

NOTE: Variables names longer than eight characters can produce incorrect output.

Shorter variable names are recommended.

----- END MATRIX -----